



What's Happening with Automotive Grade Linux and How Our Update to Yocto 5.0 Went

*Embedded Linux Conference Europe
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*Walt Miner
The Linux Foundation*

*Scott Murray
Konsulko Group*

About Walt

- AGL Development and Community Manager since 2014
- Previously at MontaVista and Mentor Graphics
- Continental AG
- Motorola Mobile Devices
- Motorola Telematics Communications Group




About Scott

- Linux user/developer since 1994
- Embedded Linux developer since 2000
- Principal Software Engineer at Konsulko Group since 2014
- Working on AGL on contract since 2016
 - Yocto Project maintenance
 - Demo development, integration, and maintenance



What is AGL?



AUTOMOTIVE
GRADE **LINUX**

the only organization
addressing
all software in the car

 <p>Infotainment</p>	 <p>Instrument Cluster</p>	 <p>Heads-up Display (HUD)</p>
 <p>Telematics/Connectivity</p>	 <p>Functional Safety</p>	 <p>Advanced Driver Assistance Systems (ADAS)</p>

- Non-profit organization
- Open source Linux-based collaborative project
- Hosted at Linux Foundation
- Collaborating to build the car of the future through *rapid innovation* by uniting the automotive and software industries

Total of 9 OEMs supporting AGL!





Millions of vehicles on the road with AGL AGL first shipped in the 2018 Toyota Camry

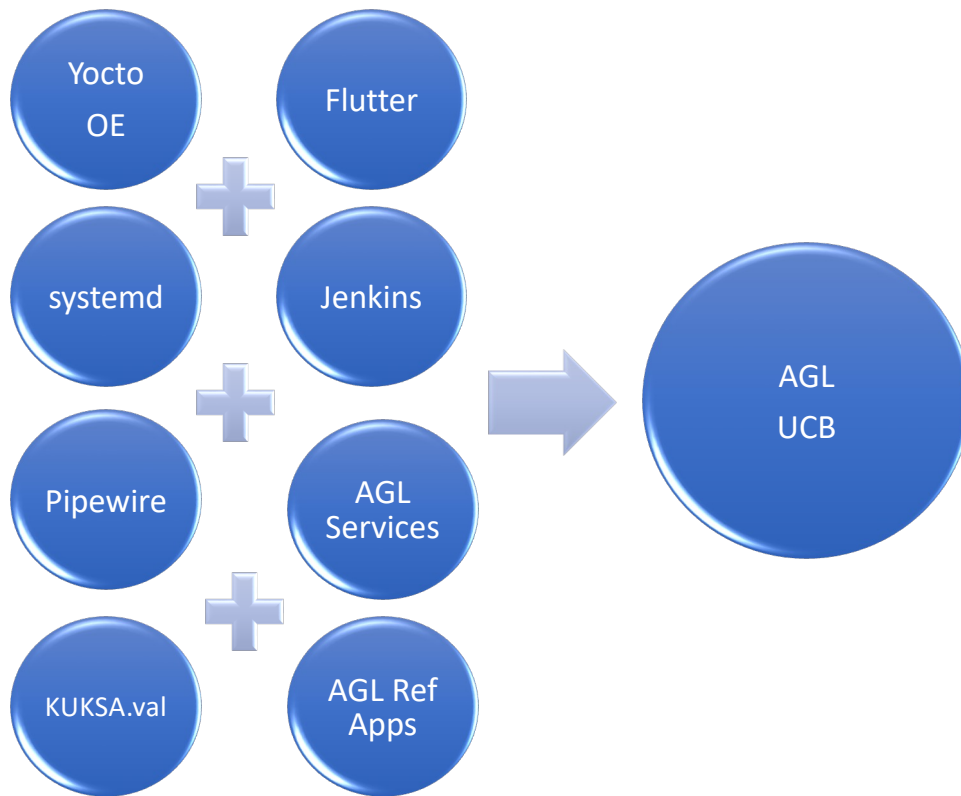


Vehicles with AGL:

- Toyota Camry, RAV4
- Toyota Prius Prime
- Lexus RX350, RX450
- Subaru Legacy, Outback
- Mercedes-Benz Vans
- More to come....

Camry image for depiction purposes only, actual vehicle may vary.

AGL Distro “Unified Code Base”

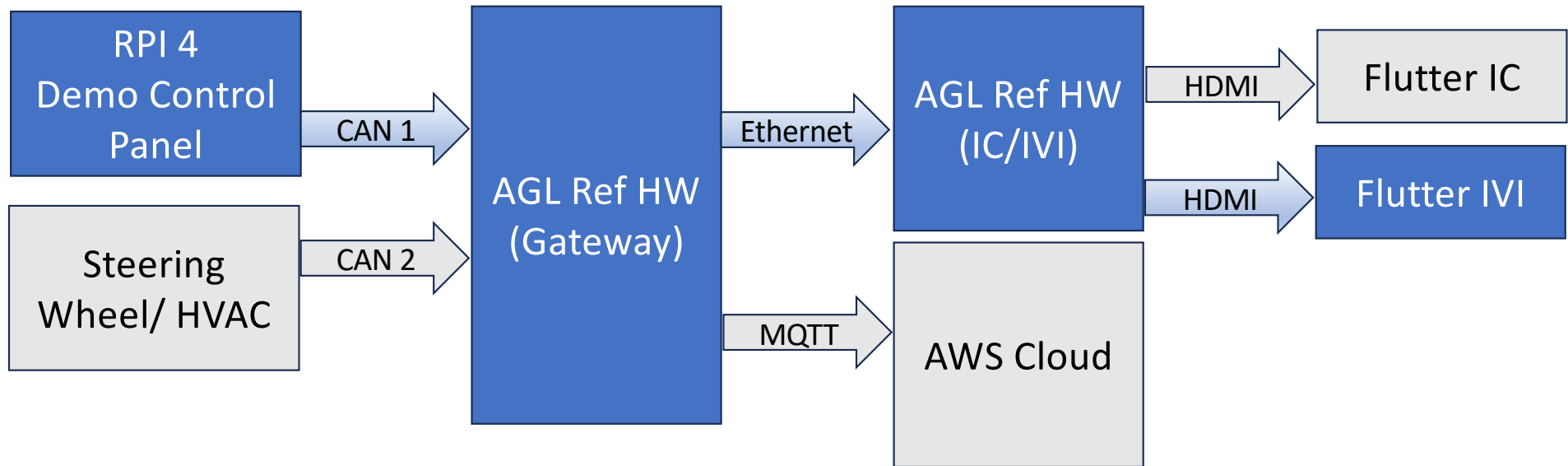


- *Unifying the best of Open Source into a single shared code base for the entire industry!*
- *Reduce fragmentation, focus on innovation and new features!*
- *Completely open source and transparent!*
- *Fully customizable; supported by an ecosystem of Tier Ones and service providers*

Device Profiles

- IC Expert Group has multiple IC configurations including bare metal Linux and container versions
- IVI Expert Group bringing embedded Flutter into vehicle
- Connectivity Expert Group created gateway device














Embedded World – Gateway demo



- Demo Control Panel sends speed and other vehicle data. Steering Wheel/HVAC CAN sends data usually directly connected to the IVI/IC hardware.
- Gateway aggregates data and forwards to AWS Cloud and IC/IVI
- Makes use of COVESA VSS and KUKSA.val implementation as vehicle data model
- All code is available in Ricefish 18.0.0

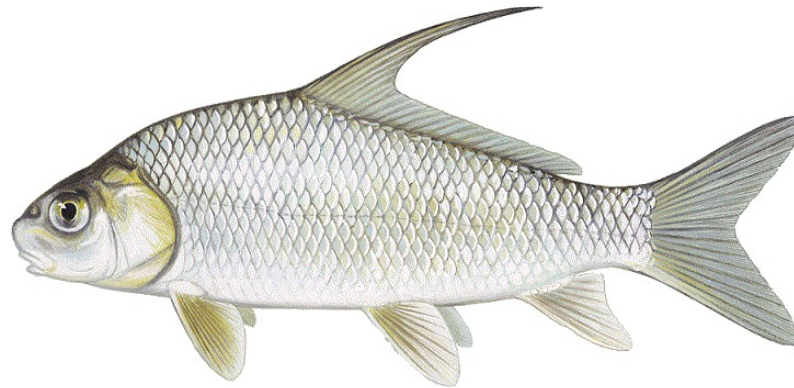
AGL Aquarium

Two releases per year, every year since 2016!

AGL Release	Code Name	Release Date	Fish
AA (1.0)	Agile Albacore	January 2016	
BB (2.0)	Brilliant Blowfish	July 2016	
CC (3.0)	Charming Chinook	January 2017	
DD (4.0)	Daring Dab	July 2017	
EE (5.0)	Electric Eel	January 2018	
FF (6.0)	Funky Flounder	Sept 2018	
GG (7.0)	Grumpy Guppy	March 2019	
HH (8.0)	Happy Halibut	August 2019	
II (9.0)	Itchy Icefish	March 2020	
JJ (10.0)	Jumping Jellyfish	Sept 2020	
KK (11.0)	Kooky Koi	Feb 2021	
PP (16.0)	Prickly Pike	Aug 2023	
QQ (17.0)	Quirky Quillback	Feb 2024	

AGL UCB 17 - LTS

Quirky Quillback

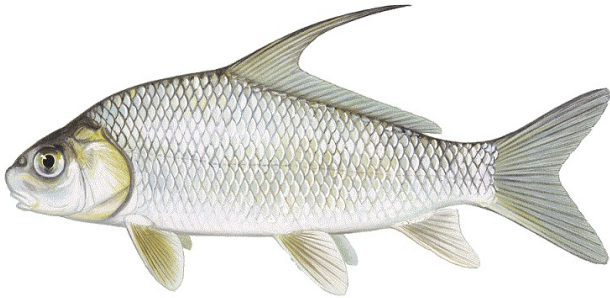


Released: Feb 26, 2024

<https://wiki.automotivelinux.org/agl-distro/release-notes>

Quirky Quillback – Release Highlights

Quirky Quillback



Released: Feb 26, 2024

- Updated to latest Yocto Kirkstone
- **NEW**: AGL UI based on Flutter
 - All AGL reference Apps converted to Flutter
- **NEW**: RISC-V architecture (SiFive board)
- **NEW**: Amazon AWS Graviton ARM64 cloud-based processor
 - Developers can develop AGL software from anywhere in the world without needing physical hardware

Announcing: AGL UCB 18

Royal Ricefish



Released: July 12, 2024

Royal Ricefish – Release Highlights

Royal Ricefish



Released: July 12, 2024

- Yocto Project 5.0 (scarthgap)
 - New Yocto LTS released in April
 - Updated all BSPs to be compatible with scarthgap
- Flutter
 - Updated Flutter embedder to use Flutter v3.19.3
 - Ivi-homescreen updated to v2.0.0
- Connectivity
 - Updated KUKSA.val to v0.45.0.
 - MQTT to VSS proxy created for gateway demo
 - Gateway demo image added
- New BSP: Raspberry Pi 5

AGL's Road to Scarthgap

AGL and Yocto LTS

- First Yocto LTS dunfell was tracked by AGL Lucky Lamprey for 12.1.x until it went EOL in April 2024
- YP 4.0.x (kirkstone) continues through April 2026
- New Yocto LTS 5.0 (Scarthgap) released in April 2024
- Quirky Quillback (17.0.x) will get YP Kirkstone updates until Kirkstone EOL

Yocto Project 5.0 AKA Scarthgap

- Yocto Project's spring 2024 Long-term support (LTS) release
- Released end of April 2024
- Support currently planned until Spring 2028
 - This is notably different than the Dunfell and Kirkstone LTS releases, which were announced as 2 years, then extended to 4 years
- Support window overlaps Kirkstone (EOL 2026)
 - AGL Quillback branch will keep tracking YP Kirkstone

Scarth Gap



Trevor Harris / Scarth Gap

https://en.wikipedia.org/wiki/List_of_hill_passes_of_the_Lake_District#Scarth_Gap_Pass

AGL's Road to Scarthgap

- YP Scarthgap support merged into AGL master branch just before Ricefish M1 milestone at the end of April.
 - Actually a week or two before YP upstream released 5.0
- How did we do this?

AGL "next" branch

- Since early in AGL, there were usually throwaway branches for doing each YP upgrade
- This changed a bit with the arrival of the YP LTS releases and AGL tracking them instead of each individual YP release
- The "next" branch started after the upgrade to YP Dunfell in 2020 to prepare for the eventual upgrade to the next LTS (YP Kirkstone)

AGL "next" branch goals

- Spread the development work for upgrades across the 2 year period between YP LTS releases
 - Avoids "big bang" integration before a AGL release
- Keep meta-agl testing done on upstream YP autobuilder working
- Tracking YP development makes us aware of any changes that would break AGL use cases and gives us time to discuss with upstream

AGL "next" branch workflow

- Branched off of AGL master branch
- Changes to support YP master branch changes added over time
- Rebased frequently to pick up new YP and AGL master branch changes
 - Typically every few weeks, sometimes longer
 - Rebases as opposed to merges to give a clean git history when changes are eventually merged into AGL master
- Testing usually done only against YP qemu machines

AGL "next" branch workflow (cont.)

- All AGL layer repositories (meta-agl, etc.) have their own "next" branches in addition to the manifest repo
- Some components like agl-compositor do as well
 - Allows carrying changes for Weston, etc. upgrades
- AGL CI does attempt to rebase the "next" branches of the layer repositories when master branch changes are merged
 - This does not always work, but does not gate CI success

AGL "next" branch and Scarthgap

- Final "next" branch rebase and updates for the Scarthgap release done shortly after Embedded World 2024
- Merged into master branch last week of April
- Culmination of two years of work by:
 - Denys Dmytriienko (denys@konsulko.com)
 - Marius Vlad (marius.vlad@collabora.com)
 - Jan-Simon Moeller (jsmoeller@linuxfoundation.org)
 - myself

Scarthgap Features

BitBake / core changes

- Unlike YP Kirkstone, no BitBake syntax changes
- Also no mass renames of variables
 - SERIAL_CONSOLE -> SERIAL_CONSOLES is probably the most impactful
- Some recipe QA checks changed to errors:
 - Patch fuzz
 - Potentially missing Upstream-Status in patches
- Host requirements now:
 - python 3.8 (ideally 3.10 or newer)
 - make 4.0
 - gcc 8.0

BitBake / core changes (cont.)

- Support for some older distributions dropped
 - Fedora < 38
 - Debian < 11
 - Ubuntu non-LTS other than 23.04
 - 18.04 LTS still technically supported, but not recommended
- Still some ongoing work to support gcc 14 on host
 - e.g. Fedora 40
 - Some fixes in the first few point releases

BitBake / core changes (cont.)

- Binary package feed support
 - Some work for Scarthgap on vetting configuration and investigating a regular test upstream
 - Likely some work required on AGL's part to help push it further upstream
- CVE checking improvements
 - Significant improvements post-Kirkstone, e.g. linux-yocto CVE tracking...
 - Currently a bit broken by upstream NVD database issues
 - Work to support other CVE databases underway, likely to be backported
- SPDX generation improvements
 - 2.0 support, 3.0 under development post-Scarthgap

Toolchain changes

- gcc
 - 11.4 -> 13.3
- llvm
 - 13.0.1 -> 18.1.6
- glibc
 - 2.35 -> 2.39
- Go
 - 1.17.3 -> 1.22.5
- clang (from meta-clang)
 - 14.0.6 -> 18.1.6

Toolchain changes - Rust

- Rust 1.59 -> 1.75
- AGL has been using 1.75 on YP Kirkstone via a meta-lts-mixins layer
 - ATM cannot build KUKSA.val databroker without ≥ 1.74
 - Deep crate dependency trees end up forcing either a Rust upgrade or forking multiple projects to patch things
- It seems likely that we will have to work on a mixin layer for newer Rust on top of Scarthgap in the future...

linux-yocto changes

- 5.15 -> 6.6
- Used for:
 - All qemu machine builds
 - Native x86-64 via reuse of qemux86-64 machine
 - New genericarm64 machine
 - For SystemReady 2.0 supporting hardware
 - AWS machine targets
 - virtio-aarch64 machine for VM guests

Notable package updates

- systemd
 - 250.5 -> 255.4
- Mesa
 - 22.0.3 -> 24.0.7
- Weston
 - 10.0.2 -> 13.0.1
- gstreamer
 - 1.20.3 -> 1.22.12
- QEMU
 - 6.2.0 -> 8.2.3

Notable systemd changes

- Support for separate /usr removed
 - i.e. YP "usrmerge" distro feature now required
 - AGL switched before YP Kirkstone upgrade
- Lots of TPM (Trusted Platform Module) and secure boot support improvements
- New system extension feature
 - Filesystem overlays automatically applied by systemd
- Much more

<https://github.com/systemd/systemd/blob/main/NEWS>

Notable QEMU changes

- VirtIO sound device
- Generic VirtIO vhost-user device
 - Allows passing through any VirtIO device to a backend
 - Useful for new VirtIO device types without explicit support
- A large number of other changes and bugfixes for VirtIO support

BSPs

- Almost all of the used BSP layers have been updated
- Includes kernel upgrades for many, e.g.:
 - Raspberry Pi: 6.1 -> 6.6
 - NXP: 6.1 -> 6.6
 - TI: 6.1 -> 6.6
 - Renesas: 5.10.41 -> 5.10.194
- Still some things missing, e.g.
 - NXP has not updated their Weston fork to 13.0

Future Development

AGL master

- 5.0.3 released and in just released in Ricefish 18.0.1
- Future 5.0.x releases will be added to Ricefish branch
- Upstream release cycle is roughly every 6 weeks
 - AGL has been somewhat mirroring that for our LTS branches
 - YP point releases pulled in and released by AGL within a couple of weeks

"next" Development

- New "next" branch already started
- Somewhat forced due to a breaking change in upstream YP master
 - New unpack directory and UNPACKDIR variable
- The AGL CI automatic rebase has been disabled to avoid meta-agl changes potentially breaking the YP autobuilder testing
 - It seems likely we will have to keep things this way until the next LTS in 2026

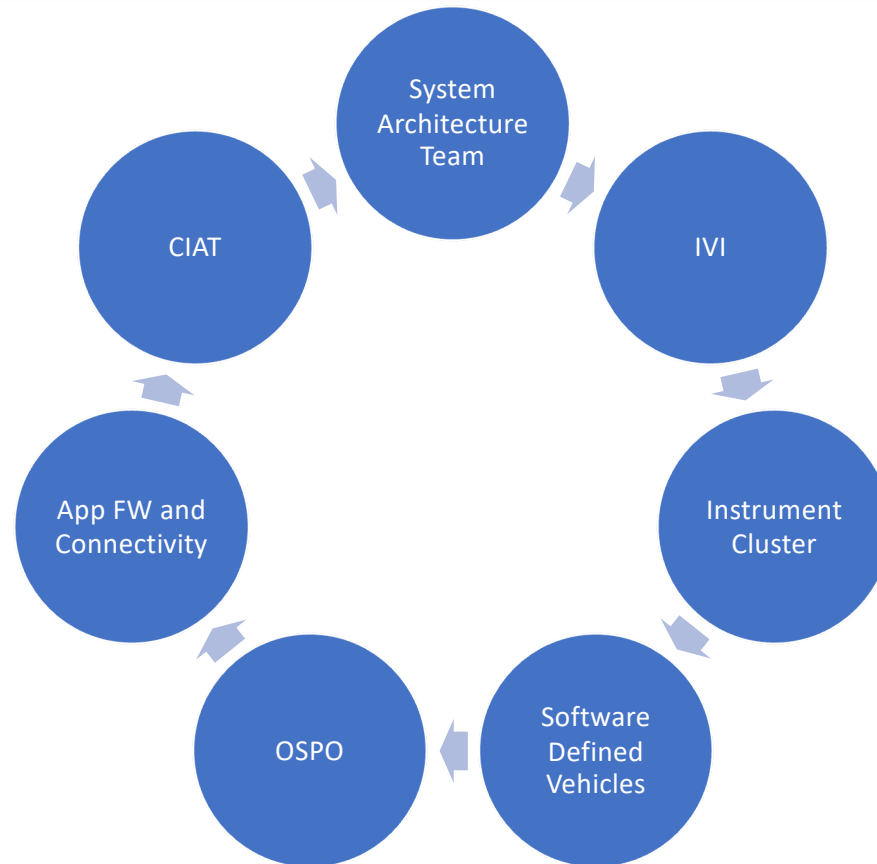
Do you want to get involved?
How can you help?
Good question!

Code First/ Upstream First

- AGL has invested in automotive software components not available anywhere else
- Continually evaluating open source technologies to find best in class for automotive use cases
- AGL has invested (provided developers and upstreamed code) in open source projects such as Pipewire, Yocto, Lava, and others.
- Willing to collaborate with anyone who brings code

Active Expert Groups

- Expert Groups facilitate collaboration between different OEMs and Tier Ones along with open source experts
- Meet every two weeks
- “You don’t have to be an expert to join an expert group” – Walt Miner
- CIAT = Continuous Integration and Automated Test



Open Source Program Office (OSPO) EG

- The Linux Foundation has numerous resource available for open source projects and OSPOs
- AGL forming an OSPO EG led by Toyota to address the special issues in the automotive community
 - Encourage participation in OSS communities
 - Contribution process for automotive companies
- Charter nearly complete and available for review on Confluence
- Biweekly meetings starting in November

SDV Expert Group

- Led by Panasonic with participation from VW, AWS, ARM and more.
- VirtIO available in UCB for hypervisor use cases
- Unified HMI – Virtual display used by different ECUs based on VirtIO (Led by Panasonic)
- Working with IC EG on container use cases
- [Confluence Page](#)

CI and Automated Test

- Jenkins and Lava used for CI – every commit run through automated testing.
- Lava labs enable remote board access.
- Weekly manual testing as well
- SBOM available for all release images

Collaboration Opportunities

- [AGL Confluence](#) with links to all Expert Groups
- SDV EG – Meets every other Tuesday at 7 am EDT
- Weekly developer call on Thursdays at 9 am EDT
- Mail list - <https://lists.automotivelinux.org/groups>
- New AGL Discord Server - <https://discord.gg/KKttfjkk>
- IRC #automotive on libera.chat

AGL Resources

- [Confluence](#) – follow links to expert groups
- [Wiki](#) – including [latest schedule](#) and [release notes](#)
- [Documentation Site](#)
- [Developer Mail list](#)
- [Getting started guide](#)
- [Git repos](#) and [gerrit](#)
- [All-Member Meeting archive](#) with videos and slides
- [Jira](#)

THANK YOU
